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(54) **SHROUD BLOCK SEGMENT FOR A GAS TURBINE**

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F01D 11/24 (2006.01)

(52) **U.S. Cl.**
CPC ***F01D 25/12*** (2013.01); ***F01D 11/24*** (2013.01); *F05D 2240/11* (2013.01); *F05D 2250/191* (2013.01); *F05D 2260/201* (2013.01); *F05D 2260/205* (2013.01)

(58) **Field of Classification Search**
CPC F01D 9/00; F01D 9/02; F01D 9/06; F01D 9/047; F01D 9/042; F01D 9/04; F01D 11/14; F01D 11/24
See application file for complete search history.

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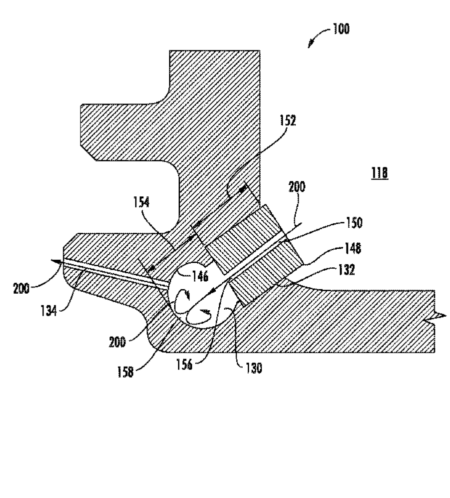
(57) **ABSTRACT**

A shroud block segment for a gas turbine includes a main body having a leading portion, a trailing portion, a first side portion and an opposing second side portion that extend axially between the leading portion and the trailing portion. The main body further includes an arcuate combustion gas side, an opposing back side and a cooling chamber defined in the back side. A cooling plenum and an exhaust passage are defined within the main body where the exhaust passage provides for fluid communication out of the cooling plenum. An insert opening extends within the main body through the back side towards the cooling plenum. A cooling flow insert is disposed within the insert opening. The cooling flow insert comprises a plurality of cooling flow passages that provide for fluid communication between the cooling chamber and the cooling plenum.

19 Claims, 11 Drawing Sheets



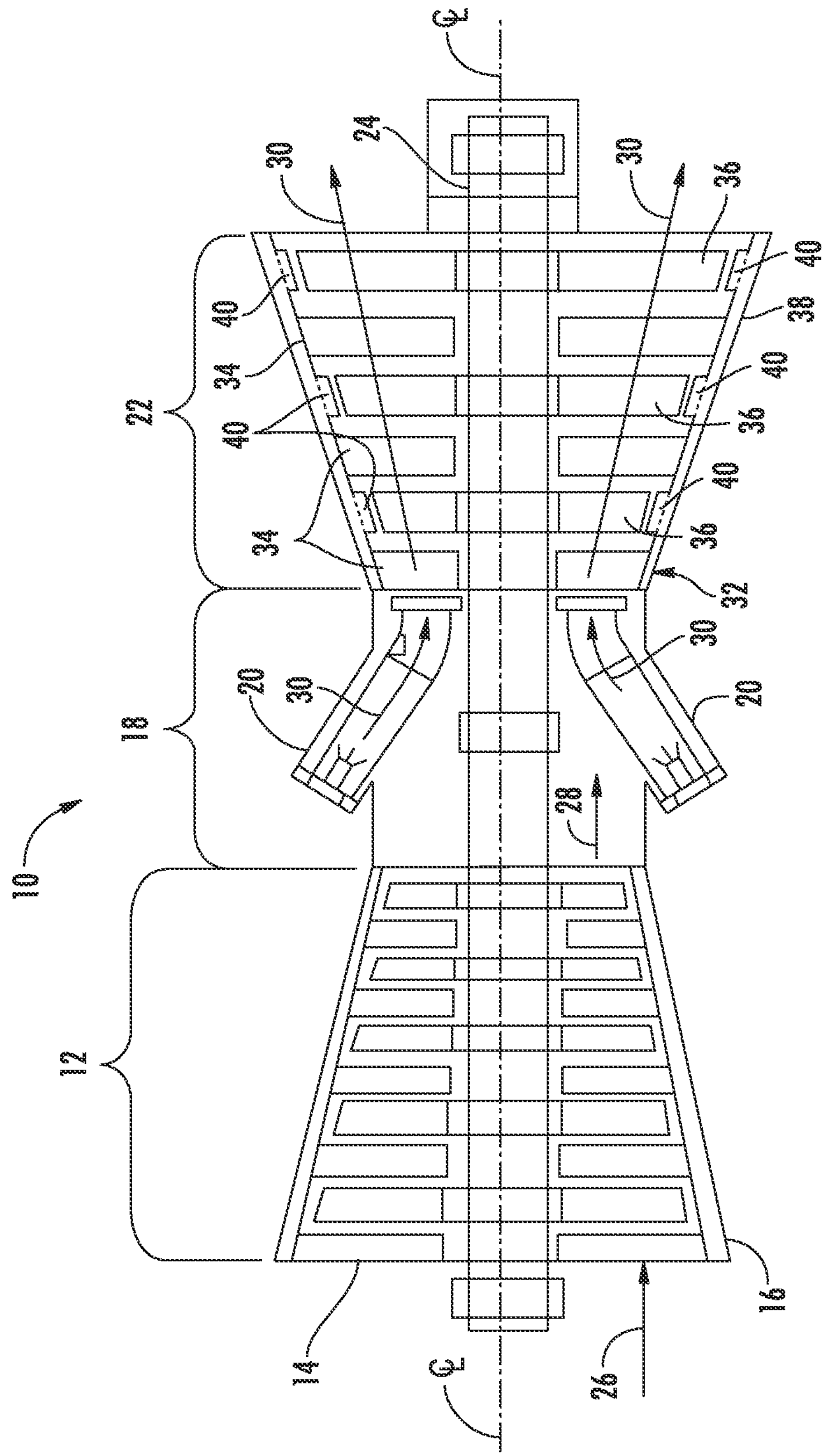

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FIG. 1

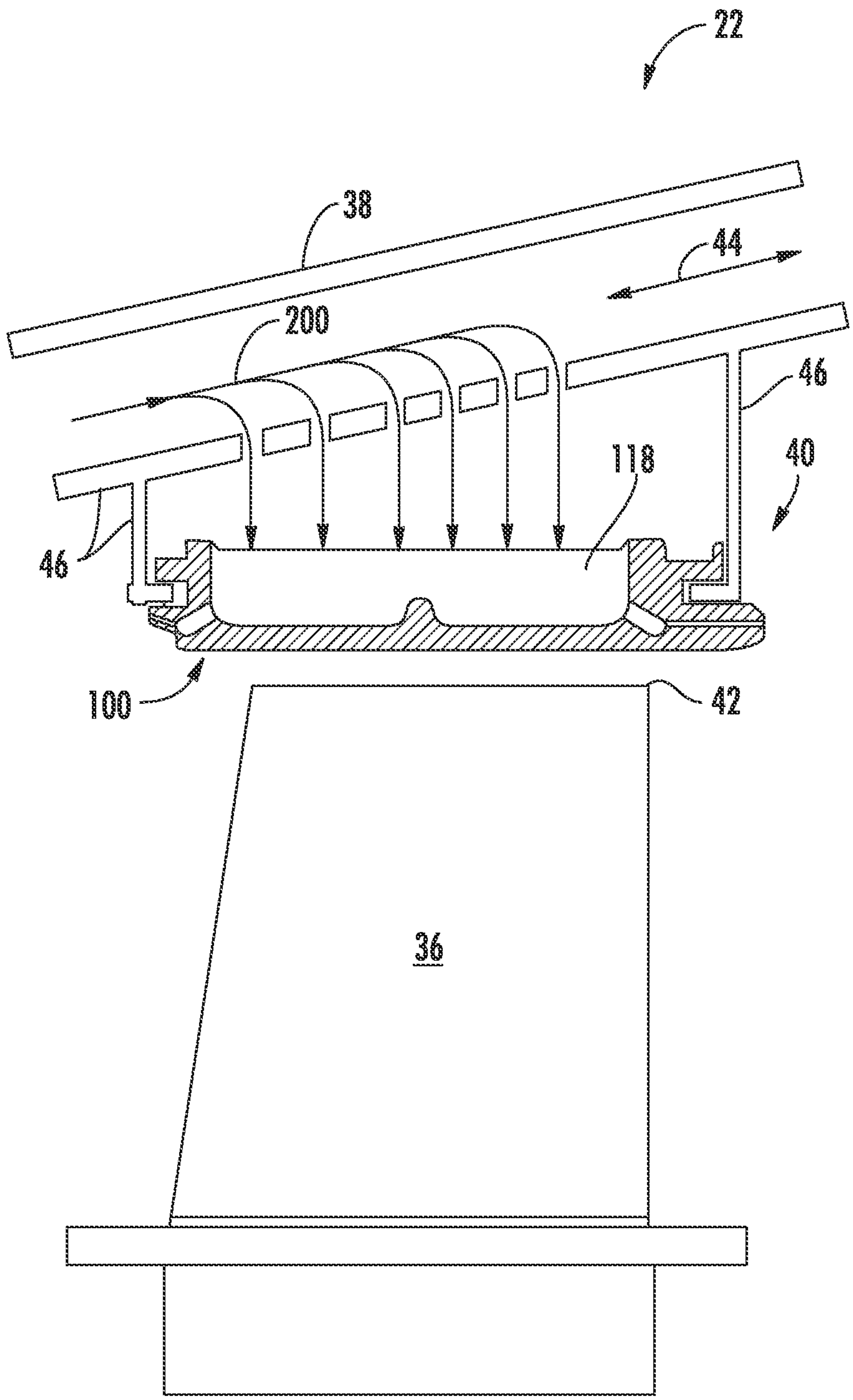

FIG. 2

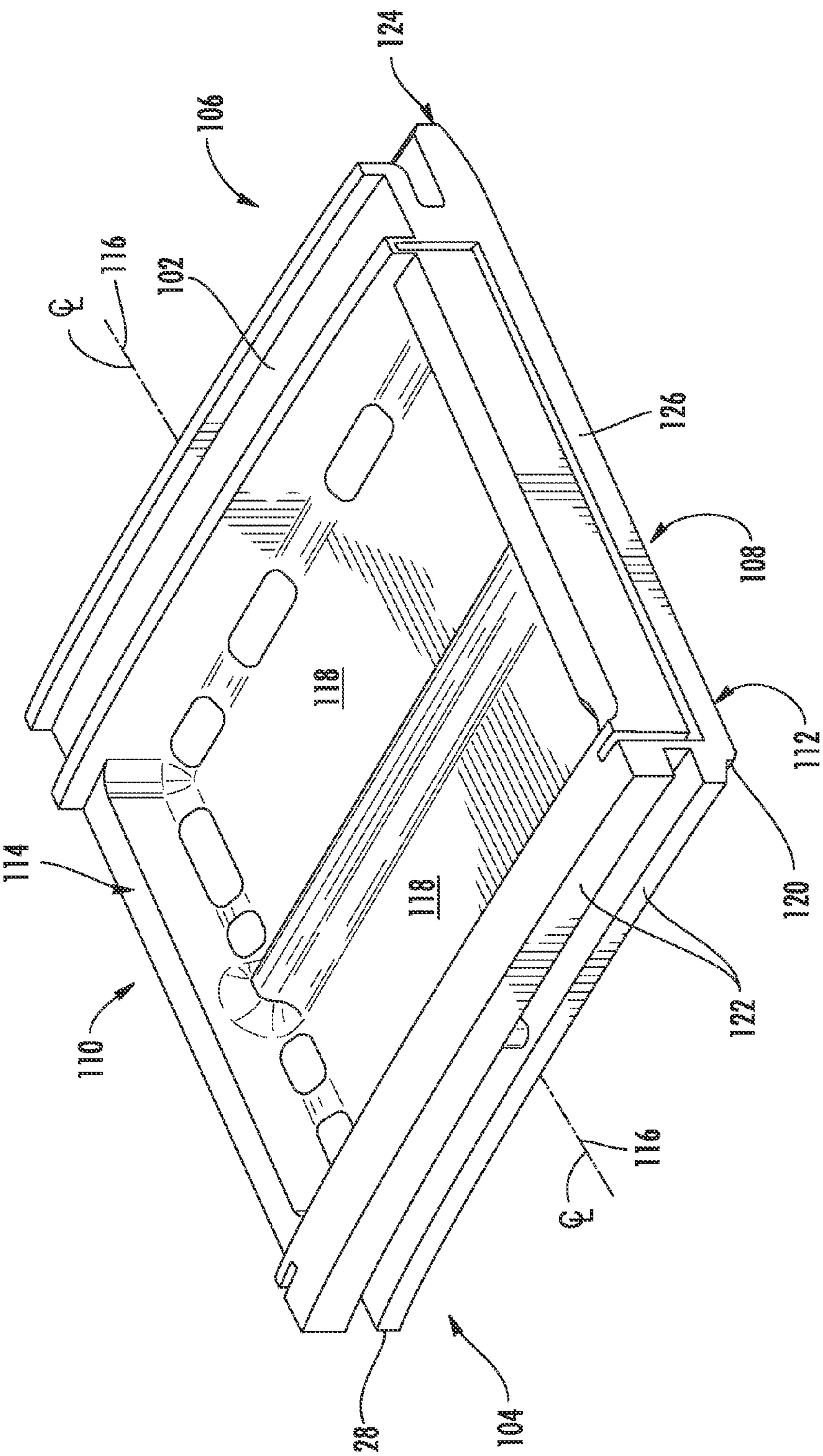
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FIG. 3

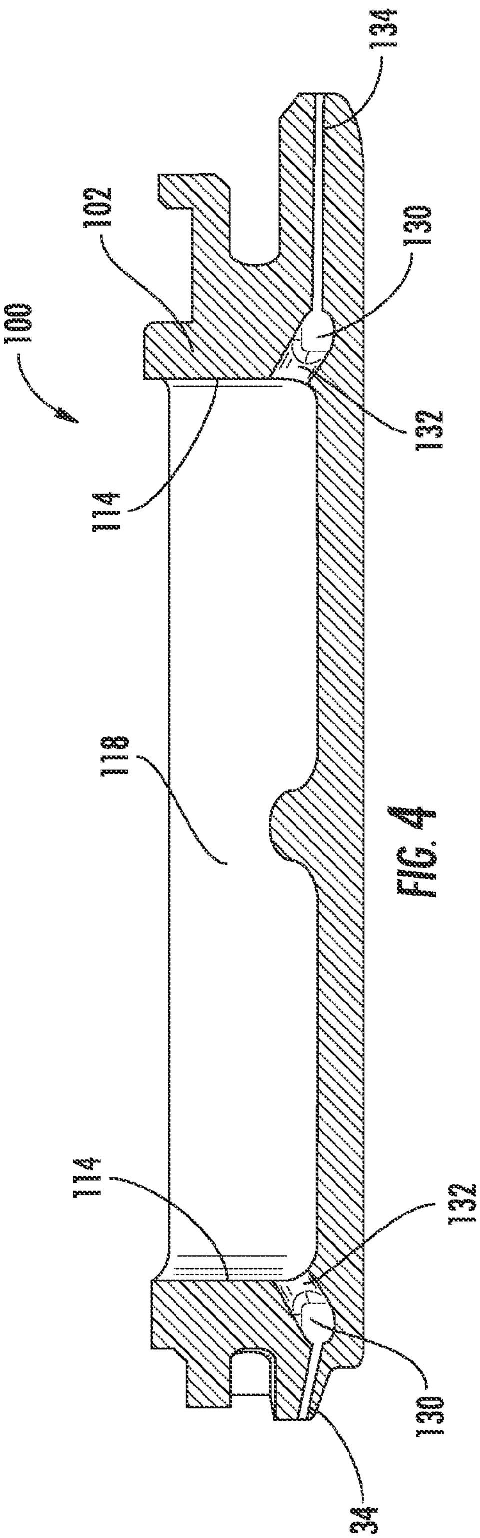

FIG. 4

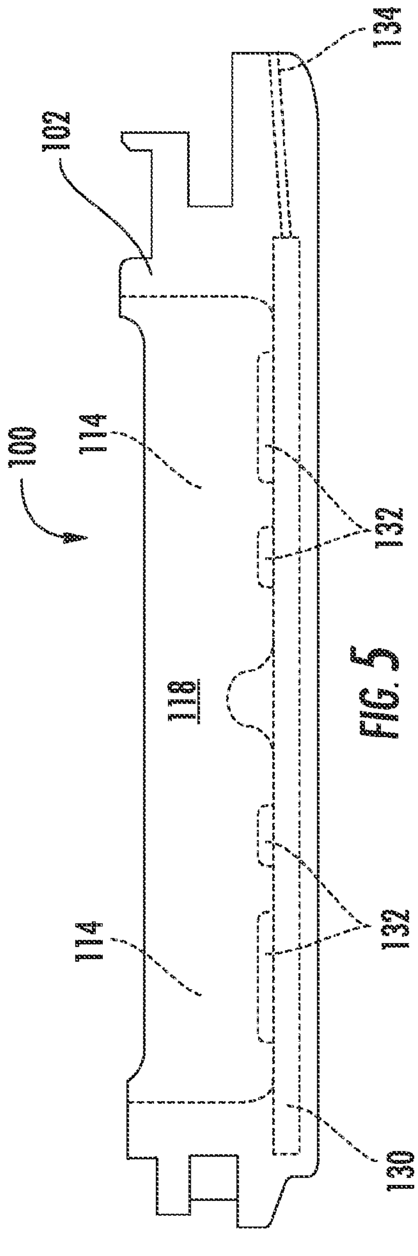

FIG. 5

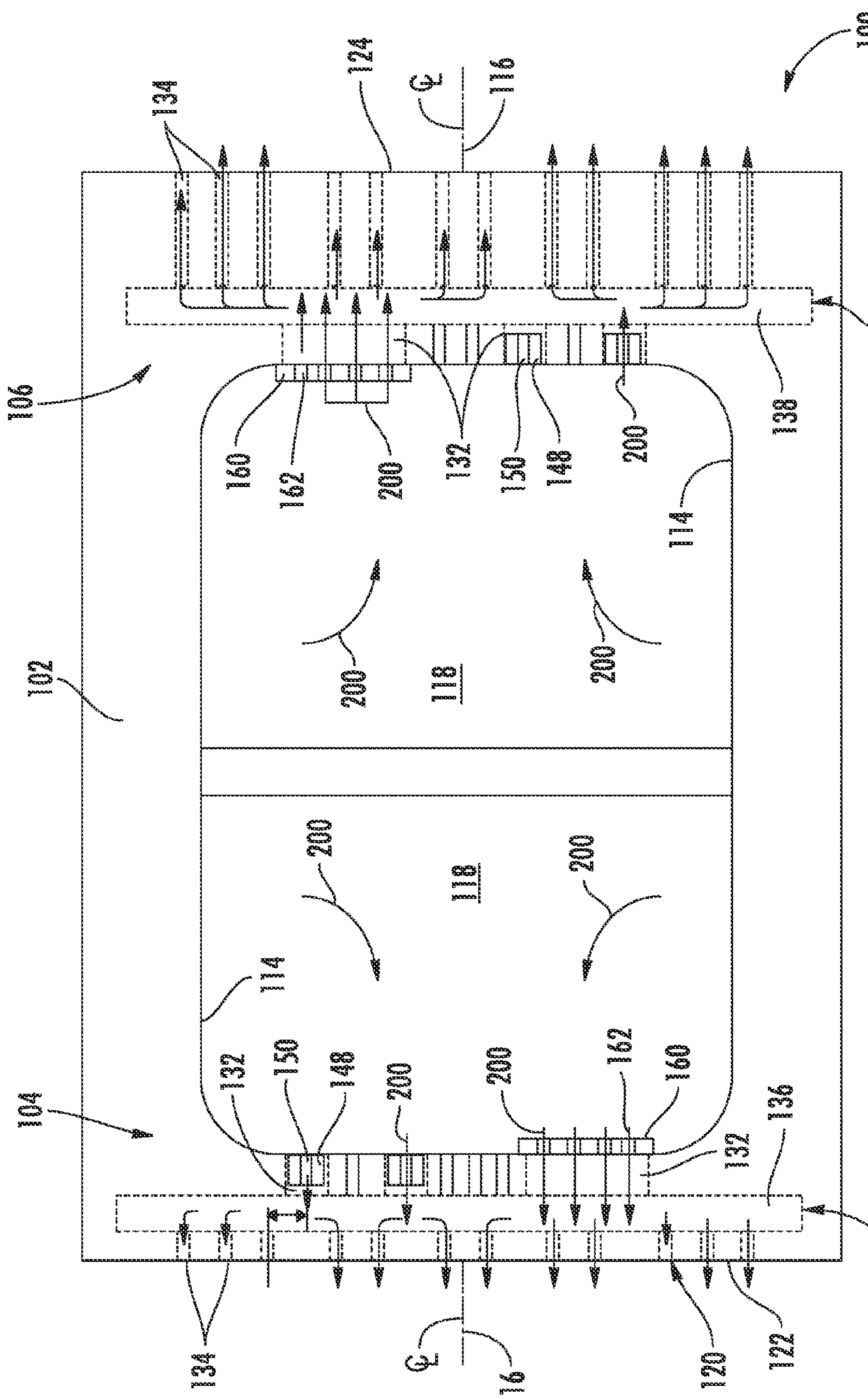
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FIG. 6

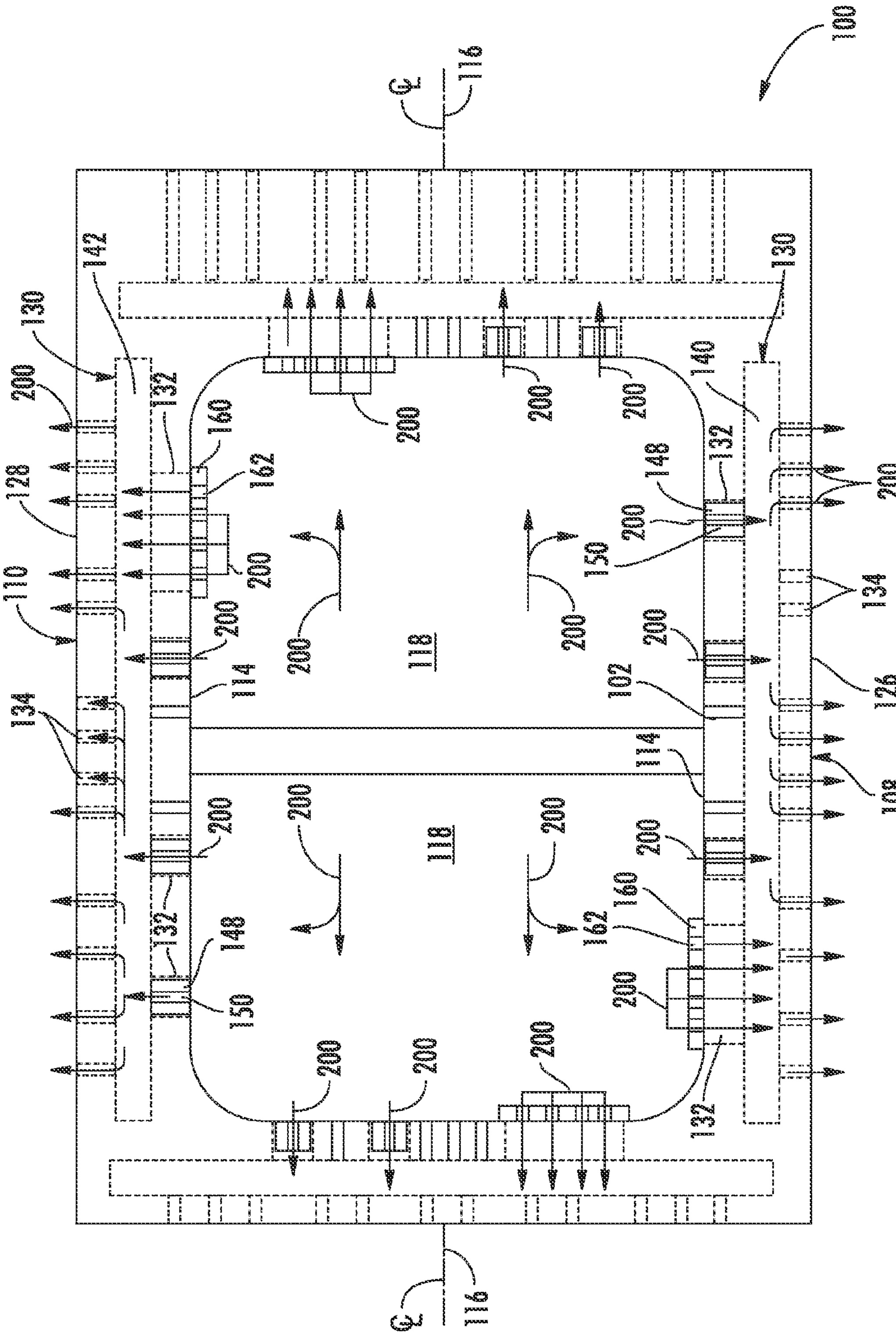
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FIG. 7

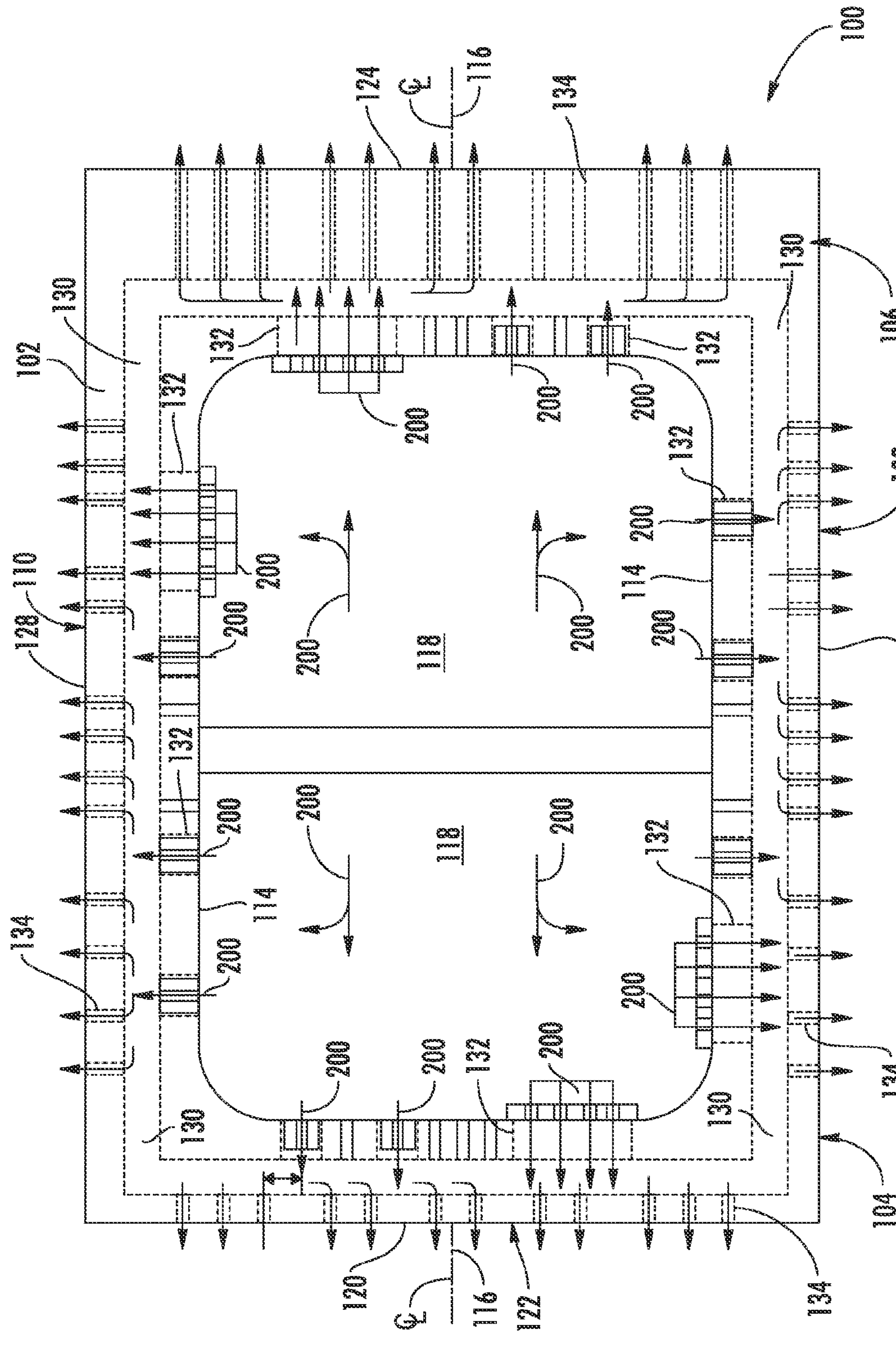
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FIG. 8

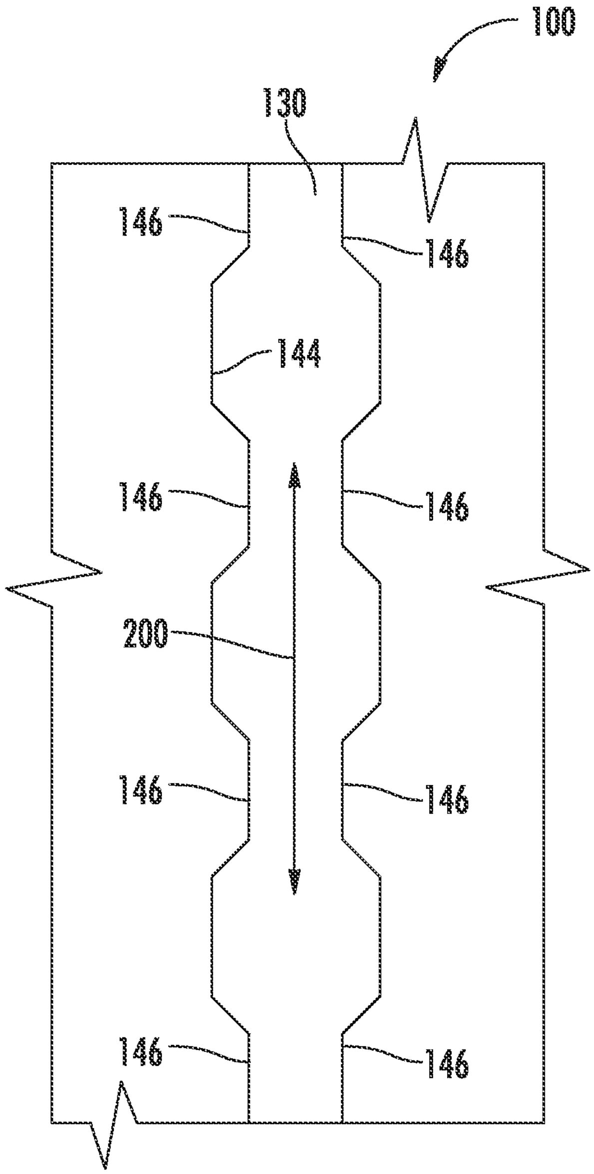

FIG. 9

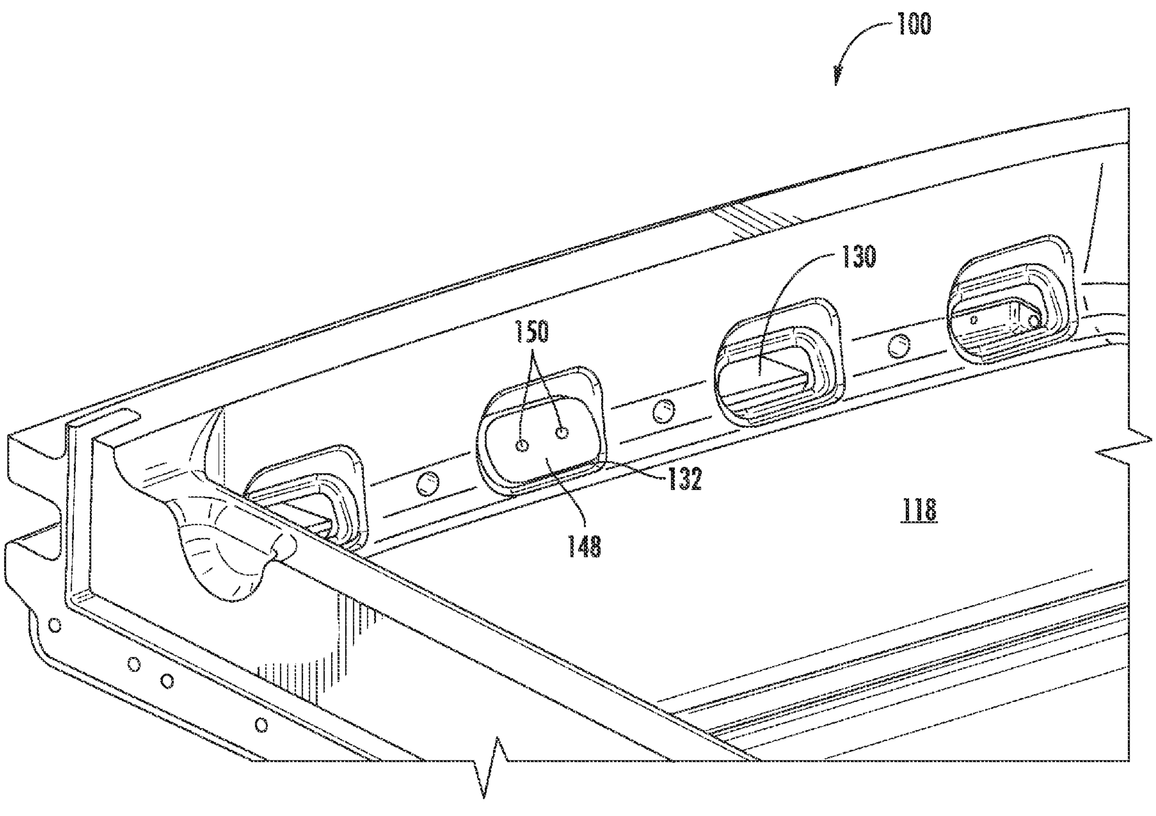

FIG. 10

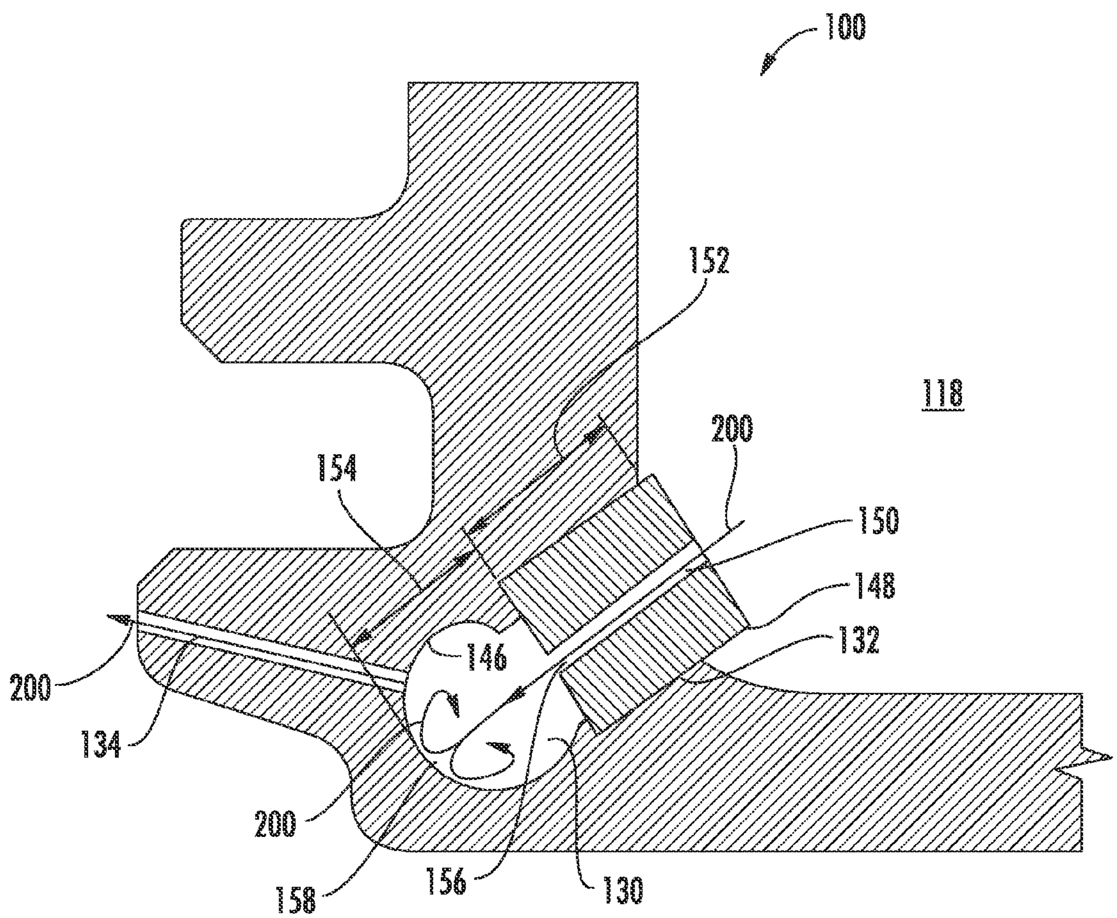

FIG. 11

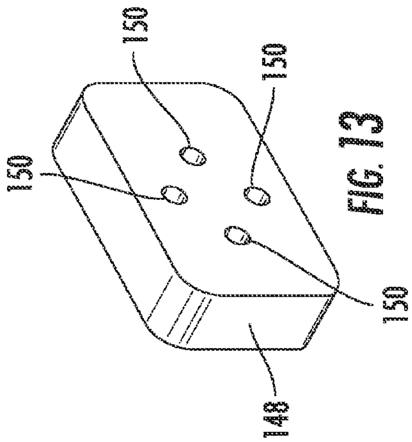

FIG. 13

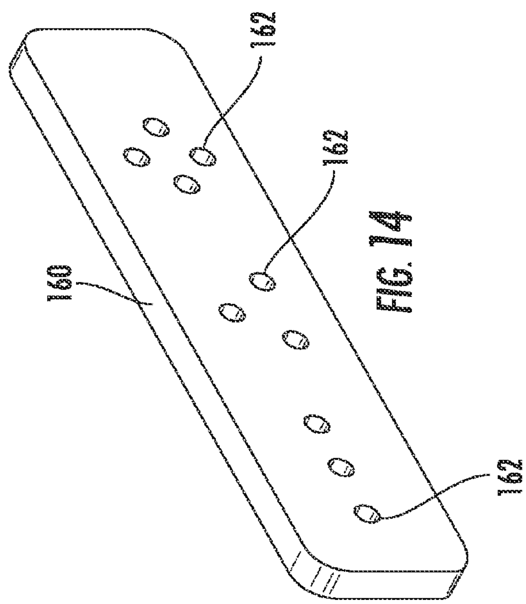

FIG. 14

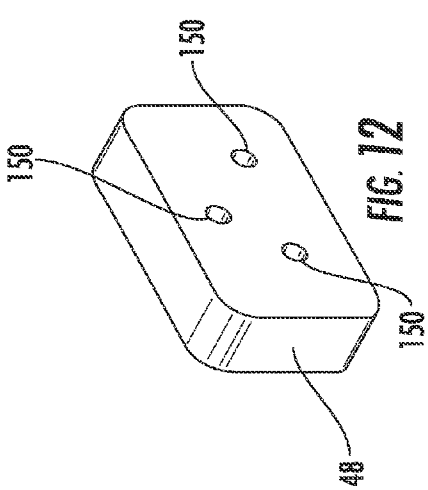

FIG. 12

SHROUD BLOCK SEGMENT FOR A GAS TURBINE

FIELD OF THE INVENTION

The present invention generally involves a gas turbine. More specifically, the invention relates to cooling of a shroud block segment within a turbine section of the gas turbine.

BACKGROUND OF THE INVENTION

A gas turbine generally includes a compressor, a combustor disposed downstream form the compressor and a turbine section disposed downstream from the combustor. A working fluid such as air enters the compressor where it is progressively compressed to provide a compressed working fluid to the combustor. Fuel is mixed with the compressed working fluid within the combustor and the mixture it is burned to produce combustion gases at a high temperature and a high velocity. The combustion gases are then routed from the combustor into the turbine section where thermal and/or kinetic energy are extracted to produce work.

The turbine section generally includes a plurality of rotor blades that extend radially from a rotor disk that is coupled to a rotor shaft. The rotor blades are circumferentially surrounded by a casing. Each rotor blade includes a blade tip that is defined at a distal or radial end of the rotor blade. A shroud assembly extends circumferentially within the casing around the plurality of rotor blades. The shroud assembly is typically mounted to an inner surface of the casing. The shroud assembly often comprises a number of shroud block segments that are arranged in an annular array around the tips of the rotor blades.

The plurality of rotor blades and the shroud block segments at least partially define a hot gas path for routing the hot combustion gases through the turbine section. A small radial gap is generally defined between the blade tips and a hot side portion of the shroud block segments. The radial gap is designed or sized to provide radial clearance between the blade tips and the hot side portion of the shroud block segments, while also providing a partial fluidic seal to control leakage of the combustion gases over the blade tips during operation. Leakage of the combustion gases over the blade tips generally results in a decrease in overall turbine efficiency.

The rotor blades and shroud block segments, particularly the hot side portions, are subjected to the high temperature combustion gases as they flow through the turbine section. As a result, cooling of the rotor blade tips and the shroud block segments is necessary to reduce thermal stresses and to improve durability of those components. One cooling scheme for cooling shroud block segments includes directing a cooling medium such as a portion of the compressed working fluid onto a backside portion of each shroud block segment. The cooling medium is routed from the back side portion into a cooling channel that is defined within the shroud block segment via a plurality of cooling passages. The cooling medium is then exhausted into the hot gas path via one or more exhaust passages defined the shroud block segments. The cooling channel is in thermal communication with the hot side portion, thereby allowing for heat transfer between the hot side portion and the cooling medium before the cooling medium is exhausted from the cooling channel.

The cooing passages are generally machined and/or cast into the shroud block segments. Once the cooling passages have been cast and/or machined into the shroud block segment the ability to later modify the size, pattern and quantity of the cooling passages thereby modifying or tuning the cooling provided to the shroud block segment becomes limited. Therefore, a system for cooling a shroud block segment which provides for cooling flow flexibility would be useful.

BRIEF DESCRIPTION OF THE INVENTION

Aspects and advantages of the invention are set forth below in the following description, or may be obvious from the description, or may be learned through practice of the invention.

One embodiment of the present invention is a shroud block segment for a gas turbine. The shroud block segment includes a main body having a leading portion, a trailing portion and a first side portion and an opposing second side portion that extend axially between the leading portion and the trailing portion. The main body further includes an arcuate combustion gas side, an opposing back side and a cooling chamber defined in the back side. A cooling plenum and an exhaust passage are defined within the main body where the exhaust passage provides for fluid communication out of the cooling plenum. An insert opening extends within the main body through the back side towards the cooling plenum. A cooling flow insert is disposed within the insert opening. The cooling flow insert comprises a plurality of cooling flow passages that provide for fluid communication between the cooling chamber and the cooling plenum.

Another embodiment of the present invention is a shroud block segment. The shroud block segment includes a main body having a leading portion, a trailing portion and a first side portion and an opposing second side portion that extend axially between the leading portion and the trailing portion. The main body further includes an arcuate combustion gas side, an opposing back side and a cooling chamber defined in the back side. A cooling plenum is defined within the main body. An exhaust passage is defined within the main body and provides for fluid communication out of the cooling plenum. An insert opening extends within the main body through the back side towards the cooling plenum. A cooling flow impingement plate extends across the insert opening and is connected to the back side. The impingement plate comprises a plurality of cooling flow passages that provide for fluid communication between the cooling chamber and the cooling plenum.

The present invention may also include a gas turbine. The gas turbine generally includes a compressor disposed at an upstream end of the gas turbine, a combustor disposed downstream from the compressor and a turbine section disposed downstream from the combustor. The turbine section includes a plurality of rotor blades that extend radially within a turbine casing and a shroud block assembly that extends circumferentially around the rotor blades within the casing. The shroud block assembly includes a plurality of shroud block segments that are arranged in an annular array around the rotor blades. Each shroud block segment comprises a main body having a leading portion, a trailing portion and a first side portion and an opposing second side portion that extend axially between the leading portion and the trailing portion. The shroud block segments also include an arcuate combustion gas side, an opposing back side and a cooling chamber defined in the back side. A cooling plenum is defined within the main body. An exhaust passage is defined within the main body and provides for fluid communication out of the cooling plenum. An insert opening extends within the main body through the back side towards the cooling plenum. At least one of a cooling flow insert is disposed within the insert opening or a cooling flow impingement plate extends across the insert opening. At least one of the cooling flow insert or the cooling flow impingement plate define a plurality of cooling flow passages that provide for fluid communication between the cooling chamber and the cooling plenum.

Those of ordinary skill in the art will better appreciate the features and aspects of such embodiments, and others, upon review of the specification.

BRIEF DESCRIPTION OF THE DRAWINGS

A full and enabling disclosure of the present invention, including the best mode thereof to one skilled in the art, is set forth more particularly in the remainder of the specification, including reference to the accompanying figures, in which:

FIG. **1** provides an example of a gas turbine as may incorporate various embodiments of the present invention;

FIG. **2** provides an enlarged cross section side view of a portion of a turbine section of the gas turbine as shown in FIG. **1**;

FIG. **3** provides a perspective view of an exemplary shroud block segment as may incorporate various embodiments of the present invention;

FIG. **4** provides an enlarged cross section side view of the shroud block segment as shown in FIG. **3**, according to one embodiment of the present invention;

FIG. **5** provides a side view of the shroud block segment as shown in FIG. **4**, according to one embodiment of the present invention;

FIG. **6** provides a partial cross section top view of the shroud block segment as shown in FIG. **3**, according to various embodiments of the present invention;

FIG. **7** provides a partial cross section top view of the shroud block segment as shown in FIG. **3**, according to various embodiments of the present invention;

FIG. **8** provides a partial cross section top view of the shroud block segment as shown in FIG. **3**, according to various embodiments of the present invention;

FIG. **9** provides an enlarged cross section of a portion of the shroud block segment as shown in FIG. **3**, according to one embodiment of the present invention;

FIG. **10** provides a partial perspective view of a portion of the shroud block segment as shown in FIG. **3**, according to one embodiment of the present invention;

FIG. **11** provides a cross section side view of a portion of the shroud block segment as shown in FIG. **3**, according to at least one embodiment of the present invention;

FIG. **12** provides a perspective view of a cooling flow insert according to one embodiment of the present invention;

FIG. **13** provides a perspective view of a cooling flow insert according to one embodiment of the present invention; and

FIG. **14** provides a perspective view of a cooling flow impingement plate according to at least one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made in detail to present embodiments of the invention, one or more examples of which are illustrated in the accompanying drawings. The detailed description uses numerical and letter designations to refer to features in the drawings. Like or similar designations in the drawings and description have been used to refer to like or similar parts of the invention. As used herein, the terms "first", "second", and "third" may be used interchangeably to distinguish one component from another and are not intended to signify location or importance of the individual components. The terms "upstream" and "downstream" refer to the relative direction with respect to fluid flow in a fluid pathway. For example, "upstream" refers to the direction from which the fluid flows, and "downstream" refers to the direction to which the fluid flows. The term "radially" refers to the relative direction that is substantially perpendicular to an axial centerline of a particular component, and the term "axially" refers to the relative direction that is substantially parallel to an axial centerline of a particular component.

Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that modifications and variations can be made in the present invention without departing from the scope or spirit thereof For instance, features illustrated or described as part of one embodiment may be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents. Although exemplary embodiments of the present invention will be described generally in the context of an industrial gas turbine for purposes of illustration, one of ordinary skill in the art will readily appreciate that embodiments of the present invention may be applied to any turbomachine and is not limited to an industrial gas turbine unless specifically recited in the claims.

Referring now to the drawings, wherein like numerals refer to like components, FIG. **1** illustrates an example of a gas turbine **10** as may incorporate various embodiments of the present invention. As shown, the gas turbine **10** generally includes a compressor section **12** having an inlet **14** disposed at an upstream end of the gas turbine **10**, and a casing **16** that at least partially surrounds the compressor section **12**. The gas turbine **10** further includes a combustion section **18** having a combustor **20** downstream from the compressor section **12**, and a turbine section **22** downstream from the combustion section **18**. As shown, the combustion section **18** may include a plurality of the combustors **20**. A shaft **24** extends axially through the gas turbine **10**.

In operation, air **26** is drawn into the inlet **14** of the compressor section **12** and is progressively compressed to provide a compressed air **28** to the combustion section **18**. The compressed air **28** flows into the combustion section **18** and is mixed with fuel in the combustor **20** to form a combustible mixture. The combustible mixture is burned in the combustor **20**, thereby generating a hot gas **30** that flows from the combustor **20** across a first stage **32** of turbine nozzles **34** and into the turbine section **22**. The turbine section generally includes one or more rows of rotor blades **36** axially separated by an adjacent row of the turbine nozzles **34**. The rotor blades **36** are coupled to the rotor shaft **24** via a rotor disk. A turbine casing **38** at least partially encases the rotor blades **36** and the turbine nozzles **34**. Each or some of the rows of rotor blades **36** may be circumferentially surrounded by a shroud block assembly **40** that is disposed within the turbine casing **38**. The hot gas **30** rapidly expands as it flows through the turbine section **22**. Thermal and/or kinetic energy is transferred from the hot gas **30** to each stage of the rotor blades **36**, thereby causing the shaft **24** to rotate and produce mechanical work. The shaft **24** may be coupled to a load such as a generator (not shown) so as to produce electricity. In addition or in the alternative, the shaft **24** may be used to drive the compressor section **12** of the gas turbine.

FIG. **2** provides an enlarged cross section side view of a portion of the turbine section **22** including an exemplary rotor blade **36** and a portion of the shroud block assembly **40** according to various embodiments of the present disclosure. As shown in FIG. **2**, the shroud block assembly **40** generally extends radially between the turbine casing and a tip portion **42** of the rotor blade **36**. The shroud block assembly **40** is in fluid communication with a cooling flow path **44**. The cooling flow path **44** may be at least partially defined by the outer casing **38**. The shroud block assembly **40** generally includes mounting hardware **46** for securing the shroud block assembly **40** to the turbine casing **38** and/or for supporting a plurality of shroud block segments **100** that are arranged in an annular array around the rotor blades **36** within the turbine casing **38**.

FIG. **3** provides a perspective view of the shroud block segment **100** as shown in FIG. **2**, according to various embodiments. As shown in FIG. **3**, the shroud block segment **100** includes a main body **102** having a leading portion **104**, a trailing portion **106**, a first side portion **108** and an opposing second side portion **110**. The first and the second side portions **108**, **110** extend axially between the leading portion **104** and the trailing portion **106**. The main body **102** further includes a combustion gas side **112** that is radially separated from an opposing back side **114**. The combustion gas side **112** has a generally arcuate or circumferential shape with respect to an axial centerline **116** of the shroud block segment **100**. The combustion gas side **112** may be coated with a heat resistant coating such as a thermal barrier coating or the like. A cooling pocket or chamber **118** is defined in the back side **114**. The cooling chamber **118** is at least partially defined between the leading portion **104**, the trailing portion **106**, the first side portion **108** and the opposing second side portion **110**.

The leading portion **104** at least partially defines a leading edge **120** and/or a forward face **122**. The leading edge **120** and/or the forward face **122** extend transversely across the leading portion **104** between the first and second side portions **104**, **106**. The trailing portion **106** at least partially defines a trialing edge **124** that extends transversely across the trailing portion **106** between the first and second side portions **108**, **110**. The first side portion **108** at least partially defines a first mating face **126** and the second side portion **110** at least partially defines a second mating face **128**. The first and second mating faces **126**, **128** extend axially between the leading portion **104** and the trailing portion **106**.

FIG. **4** provides a cross section side view of the shroud block segment **100** as shown in FIG. **3**, according to various embodiments of the present invention, and FIG. **5** provides a cross section side view of the shroud block segment **100** as shown in FIG. **3**, according to various embodiments of the present invention. In particular embodiments, as shown in FIGS. **4** and **5**, at least one cooling plenum **130** is defined within the main body **102**. An insert opening **132** extends within the main body **102** through the back side **114** and into the cooling plenum **130**. The insert opening **132** is generally disposed within the cooling chamber **118**. As shown in FIGS. **4** and **5**, at least one exhaust passage **134** is defined within the main body **102**. The exhaust passage provides for fluid communication out of the cooling plenum **130**. The cooling plenum **130**, the insert opening **132** and/or the exhaust passage **134** may be cast into the main body **102** and/or may be machined into the main body **102**. In particular embodiments, the shroud block segment **100** may include a plurality of cooling plenums **130**, a plurality of insert openings **132** and/or a plurality of exhaust passages **134**.

FIGS. **6**, **7** and **8** provide partial cross sectional top views of the shroud block segment **100** as shown in FIG. **3**, according to various embodiments of the present invention. In one embodiment, as shown in FIG. **6**, a the cooling plenum **130** comprises a forward cooling plenum **136** that extends transversely with respect to centerline **116** across the main body **102** along the leading portion **104** proximate to the leading edge **120** and/or the forward face **122**. One or more exhaust passages **134** extend through at least one of the leading edge **120** and/or the forward face **122**. One or more insert openings **132** extend through the backside **114** and into the forward cooling plenum **136**.

In particular embodiments, as shown in FIG. **6**, the cooling plenum **130** comprises an aft cooling plenum **138** that extends transversely with respect to centerline **116** across the main body **102** proximate to the trailing portion **106** and/or the trailing edge **124**. One or more exhaust passages **134** extend through the trailing portion **106** and/or the trialing edge **124**. One or more insert openings **132** extend through the backside **114** and into the aft cooling plenum **138**.

In particular embodiments, as shown in FIG. **7**, the cooling plenum **130** comprises a first side cooling plenum **140** that extends axially within the main body **102** with respect to the centerline **116** proximate to the first side portion **108**. One or more exhaust passages **134** extend through the first mating face **126**. One or more insert openings **132** extend through the backside **114** and into the first side cooling plenum **140**. In addition or in the alternative, the cooling plenum **130** may comprise a second side cooling plenum **142** that extends axially within the main body **102** with respect to the centerline **116** proximate to the second side portion **110**. One or more exhaust passages **134** extend through the second mating face **128**. One or more insert openings **132** extend through the backside **114** and into the second side cooling plenum **142**.

In one embodiment, as shown in FIG. **8**, the cooling plenum **130** may extend within the main body **102** continuously. For example, the cooling plenum **130** may extend transversely across the leading portion **104** and the trialing portion **106** and extend axially therebetween along both the first side portion **108** and the second side portion **110**. One or more insert openings **132** extend through the backside **114** and into cooling plenum **130**. Exhaust passages **134** extend through each or some of the leading edge **120**, the forward face **122**, the first mating face **126**, the second mating face **128**, the trailing portion **106** and/or the trialing edge **124**.

FIG. **9** provides a cross section top view of a portion of the shroud block segment **100** including a portion of the cooling plenum **130** which may be representative of each or some of the forward cooling plenum **136**, the aft cooling plenum **138** and/or the first and second side cooling plenums **140**, **142** according to one embodiment. As shown in FIG. **9**, the cooling plenum **130** may include a profiled inner surface **144** including a ridge **146** or other surface feature that is operative to affect a flow of a pressurized cooling medium that flows within the cooling plenum **130**. The profiled inner surface **144** may be included as a feature of any of the forward cooling plenum **136**, the aft cooling plenum **138** and/or the first and second side cooling plenums **140**, **142** as described above. The ridges **146** may decrease an inner diameter of the cooling plenum **130**. The ridges **146** may be formed using a machining tool such as an EDM probe that is inserted into the cooling plenum **130**. In the alternative, the ridges **146** may be cast into the cooling plenum **130**.

FIG. **10** provides a partial perspective view of the cooling block segment **100** as shown in FIG. **3**, according to one embodiment of the present invention. As shown in FIG. **10**, a cooling flow insert **148** is disposed within a corresponding insert opening **132**. In particular embodiments, as shown in FIGS. **6**, **7** and **9** a plurality of cooling flow inserts **148** is disposed in each or some of the insert openings **132**.

FIG. **11** provides an enlarged cross section side view of a portion of the cooling block segment **100** as shown in FIG. **10**, according to one embodiment. As shown in FIGS. **10** and **11**, one or more cooling flow passages **150** provide for fluid communication between the cooling chamber **118** and the cooling plenum **130**. As shown in FIG. **11**, the cooling flow insert **148** may extend a depth **152** into the insert opening **132** so as to define a distance **154** between an outlet **156** of the cooling flow passage **150** and an impingement portion or contact area **158** of the cooling plenum **130**. As shown in FIG. **6**, at least some of the cooling passages **150** are offset with respect to the exhaust passages **134** so as to increase convective cooling within the cooling plenum **130** by reducing secondary flow.

FIGS. **12**, **13** provide perspective views of exemplary cooling flow inserts **148** according to various embodiments of the present invention. The cooling flow passages **150** may be arranged in any pattern and in any quantity from one to a plurality within the cooling flow insert. For example, as shown in FIG. **12** the cooling flow passages may be arranged in a triangular array. In the alternative, as shown in FIG. **13**, the cooling flow passages **150** may be arranged in a substantially circular pattern within the cooling flow insert **148**. Although the cooling flow passages **150** are generally illustrated as having a circular cross section, the cooling flow passages **150** may have any cross sectional shape and any diameter, constant or variable, so as to provide effective cooling within the cooling plenum **130** at a particular impingement portion or contact area **158** (FIG. **11**).

In one embodiment, as shown in FIG. **6**, an impingement plate **160** extends across a corresponding insert opening **132**. The impingement plate **160** may be connected to the back side **114**. The impingement plate **160** comprises a plurality of cooling flow passages **162** that provide for fluid communication between the cooling chamber **118** and the cooling plenum **130**. FIG. **14** provides a perspective view of an exemplary impingement plate **160** according to various embodiments of the present invention. As shown, the cooling flow passages **162** may be arranged in any pattern and in any quantity from one to a plurality within the impingement plate **160**. For example, as shown in FIG. **14** the cooling flow passages may be arranged in at least one of a horizontal, a triangular or a circular array. The cooling passages **162** may be offset with respect to the exhaust passages **134**. As shown in FIGS. **6**, **7** and **8**, at least some of the cooling passages **162** are offset with respect to the exhaust passages **134** so as to increase convective cooling within the cooling plenum **130**. Although the cooling flow passages **162** are generally illustrated as having a circular cross section, the cooling flow passages **162** may have any cross sectional shape and any diameter, constant or variable, so as to provide effective cooling within the cooling plenum **130** at a particular impingement portion or contact area **158** (FIG. **11**).

In operation, as shown in the various Figs., a cooling medium **200** such as a portion of the compressed working fluid is routed from the cooling flow passage **44** into the cooling chamber **118** of the shroud block segment **100**. The cooling medium **200** is then routed from the cooling chamber through the cooling flow passages **150** and/or **162** where the velocity of the cooling medium **200** is increased. The cooling medium **200** is then impinged against the inner surface **144** and/or the ridges **146** of the cooling plenum **130** at a particular impingement portion or contact area **158** within the cooling plenum **130**. The cooling medium **200** is directed within the cooling plenum **130** towards the exhaust passages **134**, thereby providing convective cooling to a portion of the cooling plenum **130**. The offset exhaust passages **134** increase the exposure time of the cooling medium **200** to the inner surfaces **144** and/or the ridges **146** of the cooling plenum, thereby increasing the cooling efficiency of the cooling medium **200**. In particular embodiments, the ridges **146** defined within the cooling plenum **130** may improve the convective cooling efficiency of the cooling medium **200** by disrupting the flow of the cooling medium **200**. A desirable effect of the ridges **146** may also include creating vortices in the flow of the cooling medium **200** that increases the convective cooling effects of the cooling medium **200**.

The various embodiments as described herein and as presented in FIGS. **2** through **14** provide various technical benefits over existing cooling schemes for providing directed cooling to various locations within the shroud block segment **100**. For example, the depth **152** at which the cooling flow insert **148** is seated into the insert opening **132** may be modified post production of the shroud block segment **100**, thereby allowing for greater flexibility in the design and usability of the particular shroud block segment **100**. In addition, the pattern and/or quantity of the cooling passages **150**, **162** may be easily changed to modify cooling of the shroud block segment **100** by replacing the cooling flow insert **150** and/or the impingement plate **160**, without having to scrap the shroud block segment **100**, thereby saving costs.

This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal language of the claims.

What is claimed is:

1. A shroud block segment: comprising:

a. a main body having a leading portion, a trailing portion, a first side portion and an opposing second side portion that extend axially between the leading portion and the trailing portion, an arcuate combustion gas side, an opposing back side and a cooling chamber defined in the back side;

b. a cooling plenum defined within the main body;

c. an exhaust passage defined within the main body, wherein the exhaust passage provides for fluid communication out of the cooling plenum;

d. an insert opening defined within a wall of the main body along the back side, wherein the insert opening extends through the wall and towards the cooling plenum; and

e. a cooling flow insert disposed within the insert opening, wherein the cooling flow insert comprises a forward portion, at least the forward portion extending within the insert opening, wherein the cooling flow insert comprises a plurality of cooling flow passages that provide for fluid communication between the cooling chamber and the cooling plenum.

2. The shroud block segment as in claim **1**, wherein at least one of the plurality of the cooling flow passages is offset with respect to the exhaust passage.

3. The shroud block segment as in claim **1**, wherein the cooling passages are arranged in one of a horizontal, triangular or circular pattern within the cooling flow insert.

4. The shroud block segment as in claim **1**, wherein the cooling plenum has an inner surface including a ridge that is operative to affect a flow of a pressurized cooling medium that flows within the cooling plenum.

5. The shroud block segment as in claim **1**, wherein the leading portion at least partially defines a leading edge and a forward face, the trailing portion at least partially defines a trialing edge, the first side portion at least partially defines a first mating face and the second side portion at least partially defines a second mating face.

6. The shroud block segment as in claim **5**, wherein the cooling plenum comprises a forward cooling plenum that extends transversely within the main body proximate to the leading edge and the exhaust passage extend through at least one of the leading edge or the leading face.

7. The shroud block segment as in claim **5**, wherein the cooling plenum comprises an aft cooling plenum that extends transversely within the main body proximate to the trailing portion and the exhaust passage extend through the trailing edge.

8. The shroud block segment as in claim **5**, wherein the cooling plenum comprises a first side cooling plenum that extends axially within the main body proximate to the first side portion and the exhaust passage extend through the first mating face.

9. The shroud block segment as in claim **5**, wherein the cooling plenum comprises a second side cooling plenum. that extends axially within the main body proximate to the second side portion and the exhaust passage extend through the second mating face.

10. A shroud block segment, comprising:

a. a main body having a leading portion, a trailing portion, a first side portion and an opposing second side portion that extend axially between the leading portion and the trailing portion, an arcuate combustion gas side, an opposing back side and a cooling chamber defined in the back side;

b. a cooling plenum defined within the main body;

c. an exhaust passage defined within the main body, wherein the exhaust passage provides for fluid communication out of the cooling plenum;

d. an insert opening that extends within the main body through the back side towards the cooling plenum;

e. a cooling flow impingement plate that extends across the insert opening and is connected to the back side, wherein the impingement plate comprises a plurality of cooling flow passages that provide for fluid communication between the cooling chamber and the cooling plenum, wherein the cooling passages are arranged in one of a triangular or circular pattern within the cooling flow impingement plate; and

f. a cooling flow insert disposed within the insert opening.

11. The shroud block segment as in claim **10**, wherein at least one of the cooling passages are offset with respect to the exhaust passage.

12. The shroud block segment as in claim **10**, wherein the cooling plenum has an inner surface including a ridge that is operative to affect a flow of a pressurized cooling medium that flows within the cooling plenum.

13. The shroud block segment as in claim **10**, wherein the leading portion at least partially defines a leading edge and a forward face, the trailing portion at least partially defines a trialing edge, the first side portion at least partially defines a first mating face and the second side portion at least partially defines a second mating face.

14. The shroud block segment as in claim **10**, wherein the cooling plenum comprises a forward cooling plenum that extends transversely within the main body proximate to the leading edge and the exhaust passage extend through at least one of the leading edge or the leading face.

15. The shroud block segment as in claim **14**, wherein the cooling plenum comprises an aft cooling plenum. that extends transversely within the main body proximate to the trailing portion and the exhaust passage extend through the trailing edge.

16. The shroud block segment as in claim **14**, wherein the cooling plenum comprises a first side cooling plenum that extends axially within the main body proximate to the first side portion and the exhaust passage extend through the first mating face.

17. The shroud block segment as in claim **14**, wherein the cooling plenum comprises as second side cooling plenum that extends axially within the main body proximate to the second side portion and the exhaust passage extend through the second mating face.

18. A gas turbine, comprising:

a. a compressor disposed at an upstream end of the gas turbine;

b. a combustor disposed downstream from the combustor; and

c. a turbine section disposed downstream from the combustor, the turbine section having a plurality of rotor blades that extend radially within a turbine casing and a shroud block assembly that extends circumferentially around the rotor blades within the casing, the shroud block assembly having a plurality of shroud block segments arranged in an annular array around the rotor blades, each shroud block segment comprising:

i. a main body having a leading portion, a trailing portion, a first side portion and an opposing second side portion that extend axially between the leading portion and the trailing portion, an arcuate combustion gas side, an opposing back side and a cooling chamber defined in the back side;

ii. a cooling plenum defined within the main body;

iii. an exhaust passage defined within the main body, wherein the exhaust passage provides for fluid communication out of the cooling plenum;

iv. an insert opening that extends within the main body through the back side towards the cooling plenum; and

v. a cooling flow insert disposed within the insert opening and a cooling flow impingement plate that extends across the insert opening, wherein at least one of the cooling flow insert and the cooling flow impingement plate at least partially define a plurality of cooling flow passages that provide for fluid communication between the cooling chamber and the cooling plenum, wherein the cooling passages are arranged in one of a triangular or circular pattern within the cooling flow impingement plate.

19. The gas turbine as in claim **18**, wherein;

a. the leading portion of the shroud block segment at least partially defines a leading edge, the trailing portion at least partially defines a trialing edge, the first side portion at least partially defines a first mating face and the second side portion at least partially defines a second mating face; and

b. the cooling plenum extends within the main body generally proximate to at least one of the leading edge, the trailing edge, the first mating face or the second mating face.

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